

IN THE CLAIMS:

1.-38. (Canceled)

39. (New) A method of forming a dielectric barrier layer, the method comprising:

providing a structure comprising an exposed copper surface; and

performing a single deposition process to form a single silicon nitride layer on said

exposed copper surface, said single silicon nitride layer having a first surface that

interfaces with said exposed copper surface and a second surface that is opposite

said first surface, wherein the parameters of said deposition process are adjusted

such that a concentration of silicon in said single silicon nitride layer gradually

increases from said first surface to said second surface.

40. (New) The method of claim 39, wherein said single deposition process is performed without interrupting a vacuum.

41. (New) The method of claim 39, wherein said single silicon nitride layer is formed while changing a first set of deposition parameters to a second set of deposition parameters.

42. (New) The method of claim 39, wherein performing said single deposition process comprises performing said deposition process with a first set of a deposition parameters and transitioning to performing said deposition process with a second set of deposition parameters that are different from said first set of deposition parameters.

43. (New) The method of claim 42, wherein said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate.

44. (New) The method of claim 42, wherein said single silicon nitride layer is deposited in a plasma ambient.

45. (New) The method of claim 39, further comprising treating said exposed copper surface by exposing the copper surface to a plasma ambient prior to forming said single silicon nitride layer.

46. (New) The method of claim 45, wherein treating said copper surface and forming said single silicon nitride layer is performed without interrupting a vacuum established over said exposed copper surface.

47. (New) The method of claim 39, wherein performing said single deposition process comprises performing said deposition process using a silane flow rate of approximately 120-170 sccm and a nitrogen flow rate of approximately 220-330 sccm and transitioning to

performing said deposition process using a silane flow rate of approximately 200-250 sccm and a nitrogen flow rate of approximately 30-80 sccm.

48. (New) A method of forming a dielectric barrier layer, the method comprising:
providing a structure comprising an exposed copper surface;
treating said exposed copper surface by exposing the copper surface to a plasma ambient;
and
after treating said exposed copper surface, performing a single deposition process to form
a single silicon nitride layer on said exposed copper surface, said single silicon
nitride layer having a first surface that interfaces with said exposed copper surface
and a second surface that is opposite said first surface, wherein the parameters of
said deposition process are adjusted such that a concentration of silicon in said
single silicon nitride layer gradually increases from said first surface to said
second surface, wherein the step of treating said exposed copper surface and
performing said single deposition process to form said single silicon nitride layer
are performed without interrupting a vacuum established over said exposed
copper surface.

49. (New) The method of claim 48, wherein said single silicon nitride layer is formed
while changing a first set of deposition parameters to a second set of deposition parameters.

50. (New) The method of claim 48, wherein performing said single deposition
process comprises performing said deposition process with a first set of a deposition parameters

and transitioning to performing said deposition process with a second set of deposition parameters that are different from said first set of deposition parameters.

51. (New) The method of claim 50, wherein said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate.

52. (New) The method of claim 50, wherein said single silicon nitride layer is deposited in a plasma ambient.

53. (New) The method of claim 48, wherein performing said single deposition process comprises performing said deposition process using a silane flow rate of approximately 120-170 sccm and a nitrogen flow rate of approximately 220-330 sccm and transitioning to performing said deposition process using a silane flow rate of approximately 200-250 sccm and a nitrogen flow rate of approximately 30-80 sccm.

54. (New) A method of forming a dielectric barrier layer, the method comprising:
providing a structure comprising an exposed copper surface; and
treating said exposed copper surface by exposing the copper surface to a plasma ambient;
after treating said exposed copper surface, performing a single deposition process to form
a single silicon nitride layer on said exposed copper surface, said single silicon nitride layer having a first surface that interfaces with said exposed copper surface and a second surface that is opposite said first surface, wherein said deposition process is performed with a first set of a deposition parameters and thereafter

performed with a second set of deposition parameters that are different from said first set of deposition parameters such that a concentration of silicon in said single silicon nitride layer gradually increases from said first surface to said second surface.

55. (New) The method of claim 54, wherein said single deposition process is performed without interrupting a vacuum.

56. (New) The method of claim 54, wherein said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate.